Appendix F

Construction History of the Tank Farm

Appendix F

Construction History of the Tank Farm

The following information about the Tank Farm construction history was developed as part of an investigation conducted by Facility Engineering from July through November 1998 to provide information about Tank Farm known and previously undocumented potential release sites. The historical construction information was obtained for areas both inside and crossing the Tank Farm boundaries as defined in the OU 3-14 Scope of Work (DOE-ID 1999a) and as shown in Figure F-1. The information focuses on the following Tank Farm topics:

- Chronology of storage tank construction
- Soil excavation required for construction
- Construction details of the 300,000-gal tanks (WM-180 through WM-190 and the 30,000-gal tanks (WM-103 through WM-106)
- Construction details of the tank vaults (CPP-780 through -786 and CPP-713)
- Construction details of valve boxes (see also Appendices A and B)
- Descriptions of the main process waste transfer pipelines both operational and abandoned within the Tank Farm and crossing the Tank Farm perimeter (see also Appendices C and D).

F-1. CHRONOLOGY

The construction of the Tank Farm began in 1951 with the installation of two 318,000-gal underground storage tanks, WM-180 and WM-181. Nine additional 300,000-gal tanks (WM-182 through WM-190) plus four 30,000-gal tanks (WM-103 through WM-106) were installed between 1954 and 1964. Tanks WM-182 through -184 were constructed concurrently with WM-103 through WM-106, followed by WM-185 and WM-186. Tanks WM-187 and -188 were installed next with construction ending with WM-189 and WM-190. Additional construction phases modified the Tank Farm by adding waste removal lines and valve boxes and by upgrading valves and existing valve boxes. Three-dimensional views of the Tank Farm looking northwest, south, and east are provided in Figures F-2, F-3, and F-4. Each construction phase of the Tank Farm is discussed in the following subsections.

F-1.1 Construction Phase 1, WM-180 and WM-181

The Tank Farm began with the construction of Tanks WM-180 and -181 and Vaults CPP-780 and -781, referred to as the "542" project. (The number designation refers to the number of the drawing used to perform the construction project.) Vault CPP-780 houses Tank WM-180, and Vault CPP-781 houses Tank WM-181. Construction began in 1951 with the excavation of the southwest corner of the Tank Farm. Both octagonal concrete vault floors were poured on bedrock. Both floors were constructed flat with sump areas cast within the vault floor for liquid drainage. Vault CPP-780 was installed with two sump areas, 2 × 2 × 4 ft deep in the southeast corner and 2.5 × 2.5 × 2 ft deep in the northeast corner. Vault CPP-781 was installed with one sump area 2 × 2 × 4 ft deep in the southwest corner.

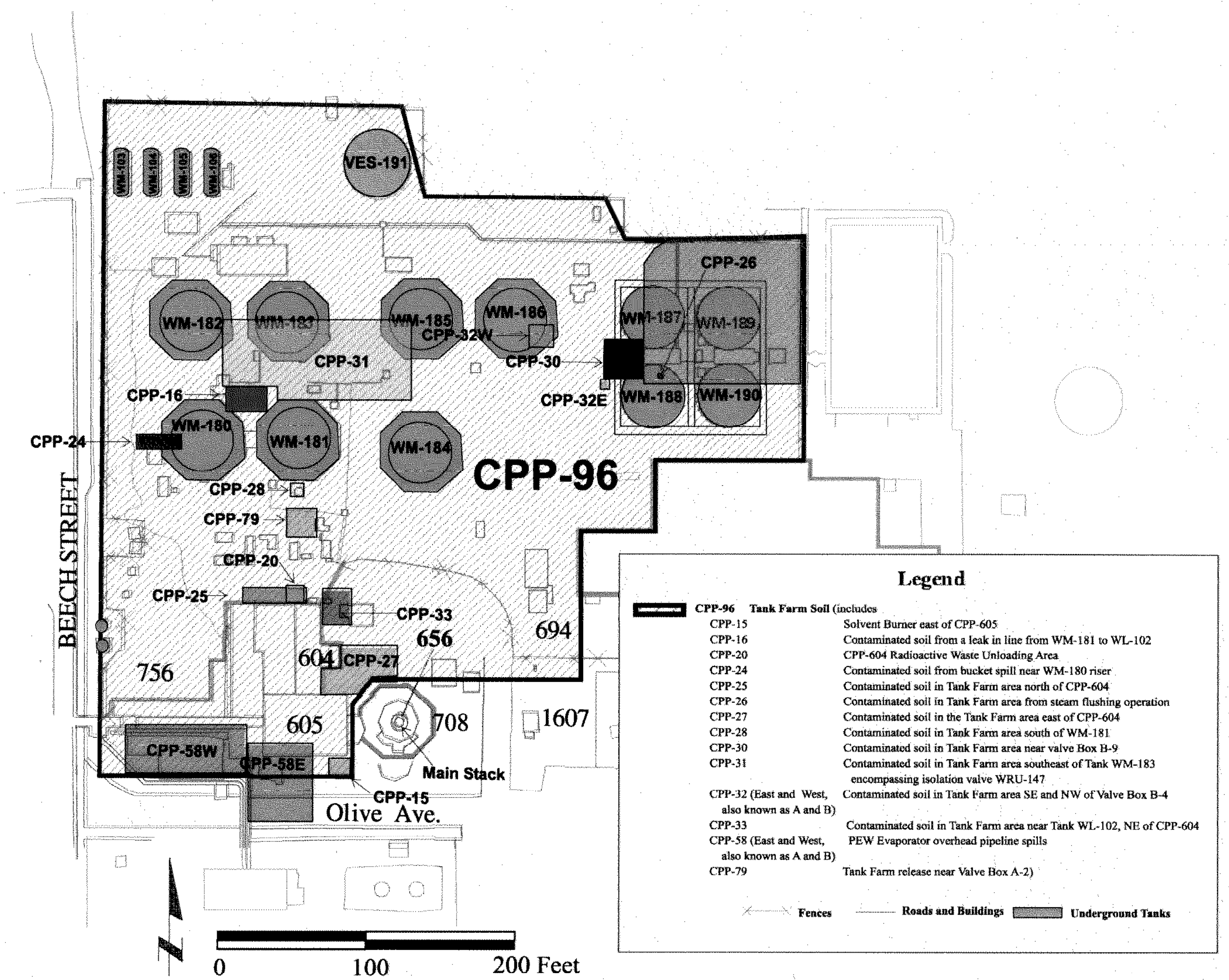

Figure F-1. Known OU 3-14 Tank Farm contaminant release sites.

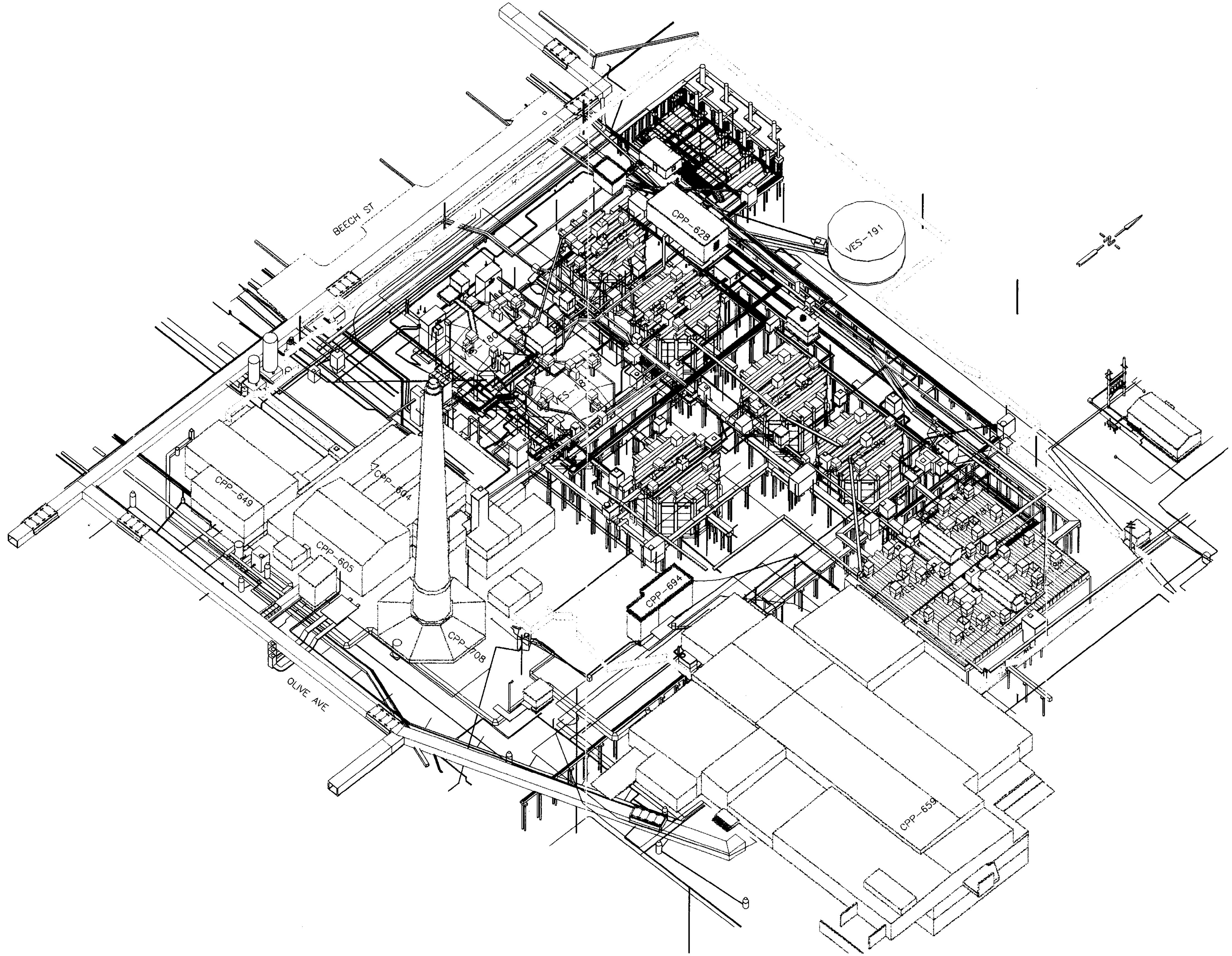

Figure F-2. Tank Farm three-dimensional view, looking northwest.

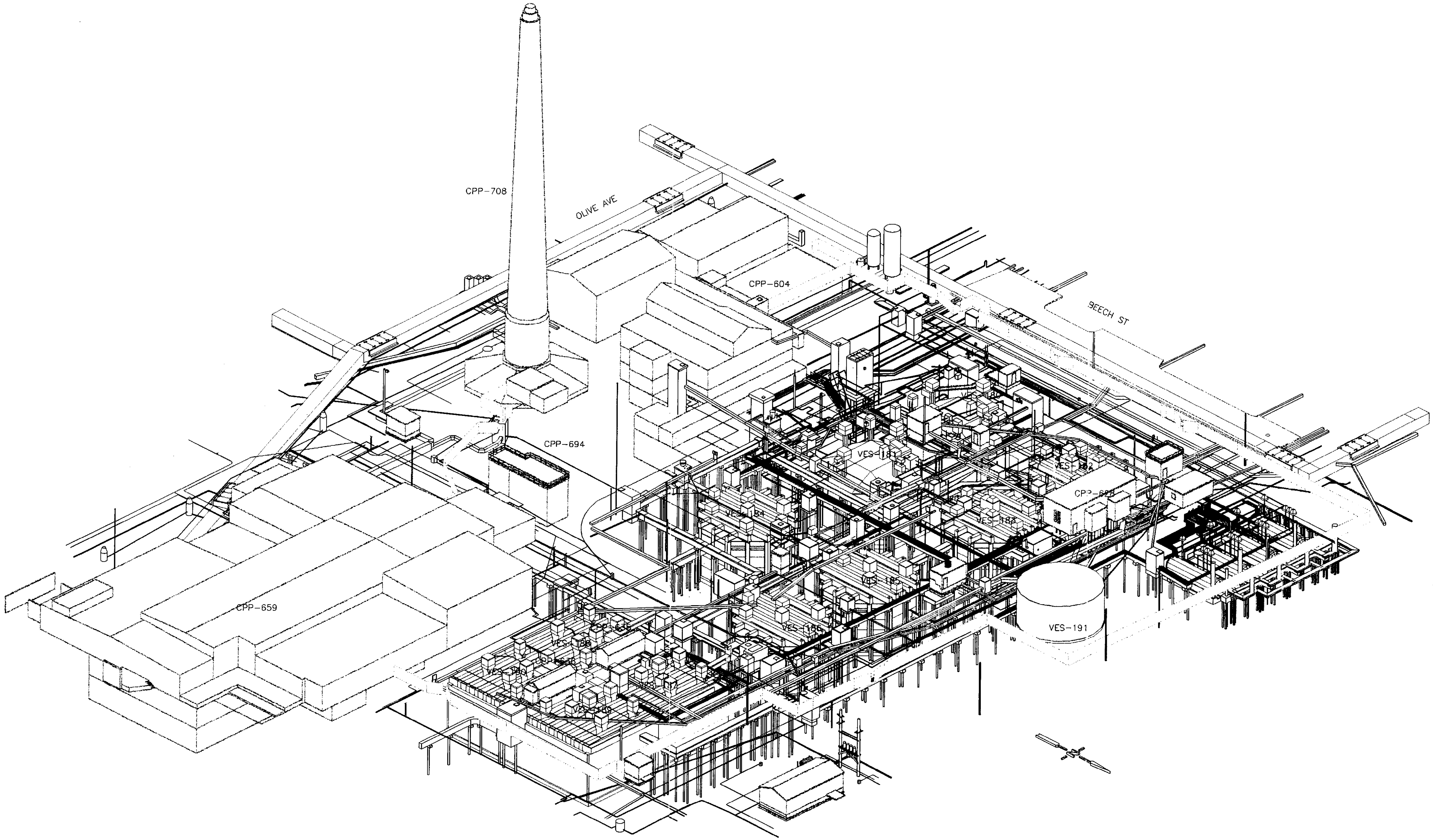

Figure F-3. Tank Farm three-dimensional view, looking southwest.

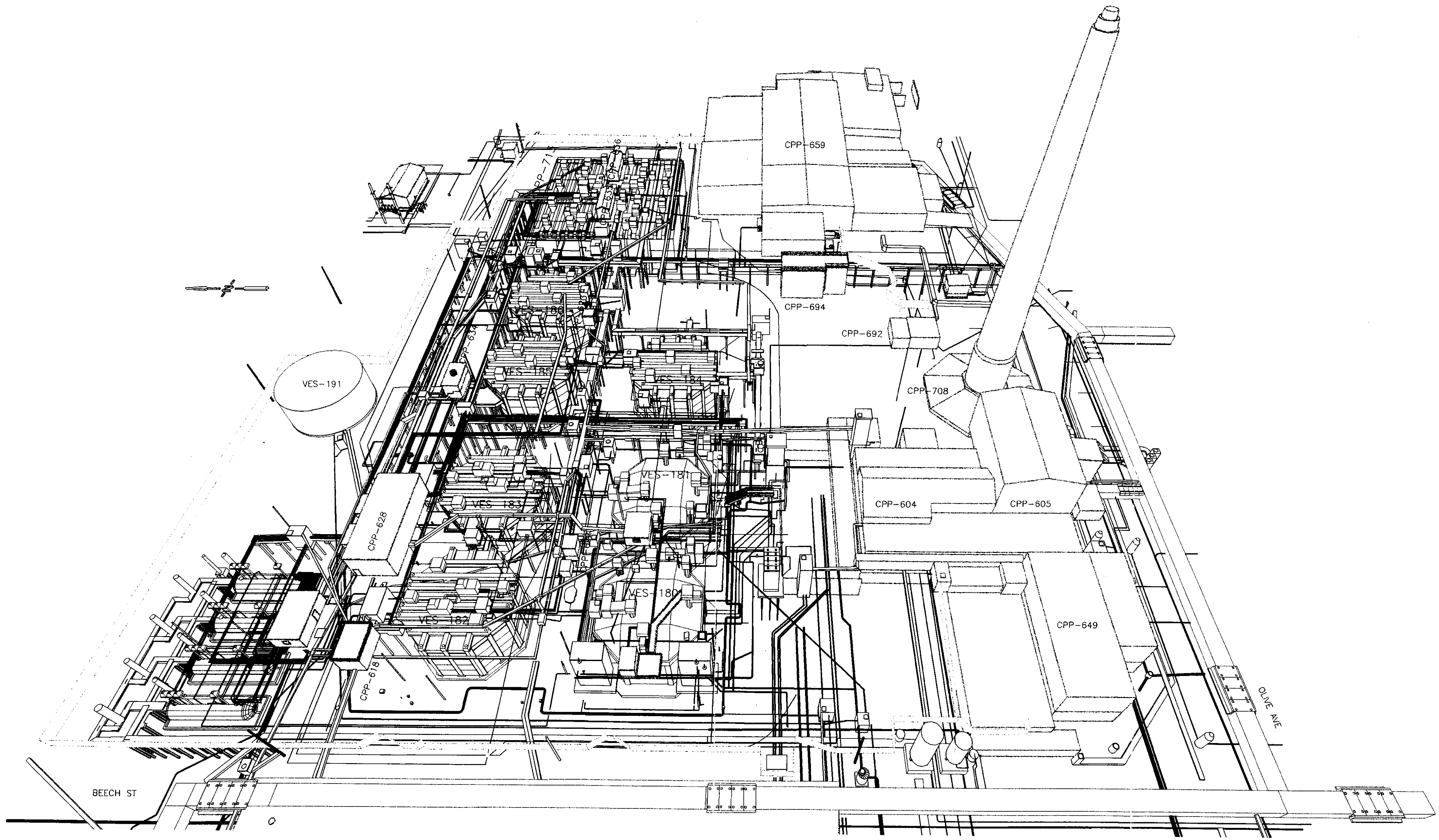

Figure F-4. Tank Farm three-dimensional view, looking east.

The concrete vault walls were cast once the vault floors were poured. Each of the two 318,000-gal liquid storage capacity tanks was then assembled and bolted to its respective vault floor. The diameter of the tanks is 15.2-m (50-ft).

Waste transfer, cooling (WM-180 only), decontamination, instrumentation, and vessel off-gas pipelines were then plumbed to the individual tanks and vaults. Split tile piping (ceramic pipe sealed together with cement mortar) was used as secondary containment for waste transfer piping running to the tanks. The secondary encasement was intended to prevent leaking radioactive waste from contaminating the surrounding soils. The continuous extension of the secondary encasement allowed leaking liquid waste to drain back into CPP-604.

Sump jet pumps were installed to remove liquid from the respective vaults. Attaching a portable, high-pressure steam source to an abovegrade hose connection activated the jet pump. As steam moved through the sump jet, vacuum was created, transferring sump liquid into the respective storage tank.

Once the tanks, vaults, and plumbing were in place, the concrete vault roof was cast in place. This enclosed each tank inside the respective vault. The vault roof was constructed to rise at an angle from the vault walls and flatten toward the middle (INTEC Drawing 103362). A Monoseal silicon sealant was placed on the vault roof as a moisture barrier. Once installation was complete, the excavation pit was then backfilled to grade level, burying the tank, vault, piping, and pipe encasements.

Additional tanks were constructed before WM-180 and -181 were filled to capacity because liquid removing devices, such as steam jets, were not installed in the storage tanks during original tank construction. These devices were not installed because an effective method of treating and storing radioactive liquid waste such as calcining was not yet available.

F-1.2 Construction Phase 2, WM-182 Through–184

Construction of Tanks WM-182 through WM-184 and Vaults CPP-782 through CPP-784 (i.e., the "4272" project) began in 1954 with the excavation of the area north and east of Tanks WM-180 and WM-181. More than likely as a cost-savings measure, the type of vault used to encase the 300,000-gal tanks changed from all poured-in-place concrete vaults for Phase 1 to pillar-and-panel vaults built in forms and then placed underground for Phases 2 and 4 (Machovec 1999). The octagonal concrete vault floor for the pillar and panel vaults was poured on bedrock first. The floor was constructed with a 4-in. slope, beginning at the floor center and tapering to the slab edge. This slope created a conical-shaped floor. Sump areas, 12 in. deep and 12 in. square, located on the north and south side of the vault were cast within the vault floor. A 6 × 6-in. curb was installed 6 ft in from the edge of the concrete base slab. The curb creates an octagonal area 51 ft wide encircling a sand pad. The sand pad was designed to cushion the tank bottom.Using concrete pillars and panels, the vault walls were erected once the vault floor was poured. The four 300,000-gal storage tanks were then assembled on the sand pad within the vault (see Figure F-5).

Waste transfer, cooling, decontamination, instrumentation, and vessel off-gas pipelines were then plumbed to the individual tanks and vaults. The waste transfer pipe running from the valve boxes to just outside the vault walls was encased in concrete enclosures with stainless steel liners to prevent radioactive waste from contaminating the surrounding soils. The concrete enclosures did not penetrate the vault, however. Pipes penetrated the vaults via a sleeve, or pipe-in-pipe encasement. Drains were installed within each concrete encasement to direct liquid from a leaking pipe or water infiltration into the nearest tank vault.

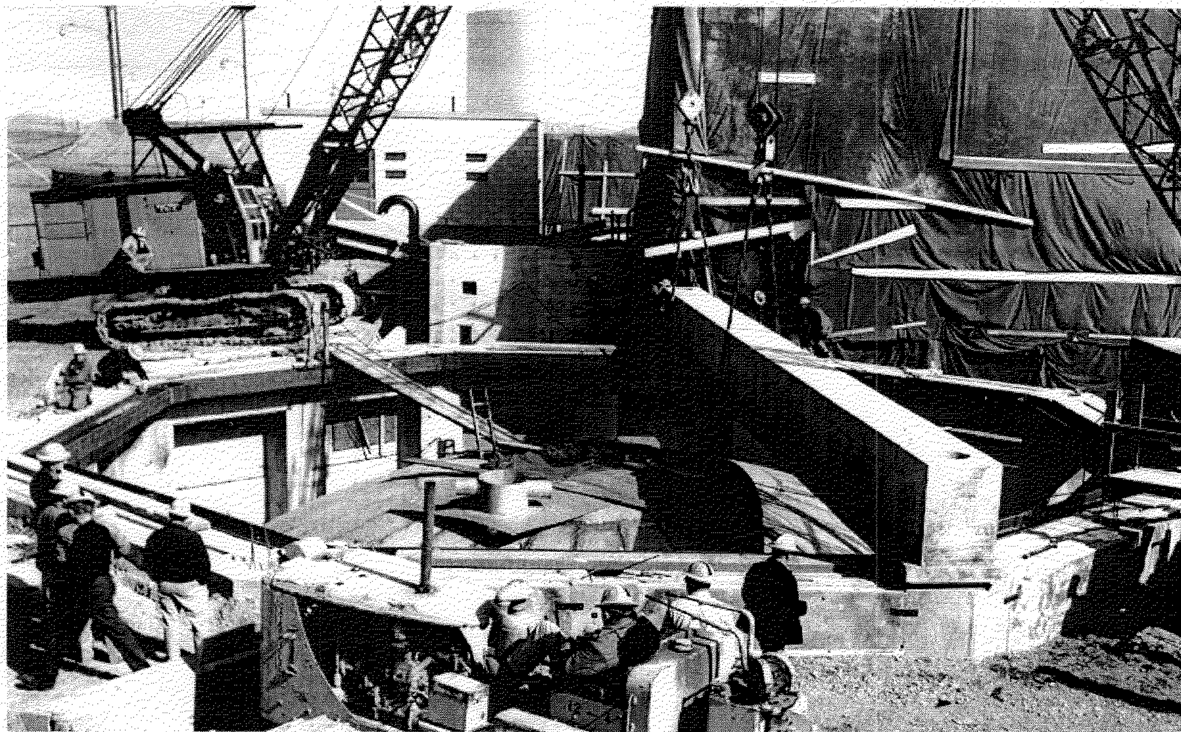

Figure F-5. Typical 300,000-gal underground pillar and panel storage tank.

Sump jets were installed into the vault sumps located on the north and south side of each tank vault bottom to provide liquid removal capabilities. As with WM-180 and WM-181, a portable, high-pressure steam source was attached to an abovegrade hose connection leading to each vault sump jet to transfer sump liquid into the respective storage tanks.

Once the tanks, vaults, and plumbing were in place, the vault roof was installed, enclosing the tank inside the vault. No moisture barrier was applied to the vault roof. Concrete platforms, supported by vertical concrete pillars, were constructed between the tank vaults (CPP-782 and CPP-783) and the Piping Control House (CPP-628) to support the cooling coils, instrumentation pipelines, process waste pipelines, and their respective encasements. The excavation pit was then backfilled to grade level, burying the tank, vault, and pipe encasements.

Additional tanks were constructed before WM-182 through -184 were filled to capacity because liquid removing jets were not yet installed inside the storage tanks. These jets were not installed because an effective method of treating and storing radioactive liquid waste, such as calcining, was not yet available.

Initially, the piping within the Tank Farm consisted of minimal pipe junctions and interfaces (i.e., valve connections). The valve connections that were made were installed inside the A series valve boxes. These valve boxes allowed easy access to valves for maintenance and provided containment for possible leaks. Drains leading to the nearest tank or vault sump were installed in each valve box.

F-1.3 Construction Phase 3, 30,000-gal Tanks

During Phase 2 construction (i.e., the 4272 project), the excavated area was expanded north of WM-182 to accommodate another fuel processing system using four 30,000-gal horizontal cylinder tanks (see Figure F-6). Construction of Phase 3 (i.e., the "4193" project) began in 1954 and ended in 1955.

Unlike the larger 300,000-gal tanks, the 30,000-gal storage tanks were not encased by concrete vaults, but were buried directly in the ground on concrete slabs. The slabs (CPP-717-A through –D), 47.5 × 17 × 1.25 ft thick were constructed with a 0.75 × 1-ft-high curb to contain leaking waste and were covered with a gravel pad. The curb and gravel construction was designed to provide base slab drainage to the sump.

Once the tanks were placed on the gravel pads, waste transfer, cooling, decontamination, instrumentation, and vessel off-gas pipelines were then plumbed to the individual tanks and vaults. The waste transfer piping running from CPP-619 and CPP-601 was encased in concrete enclosures with stainless steel liners to prevent radioactive waste from contaminating the surrounding soils. Drains were installed within each concrete encasement to direct leaking pipe liquid into the nearest tank base slab sump.

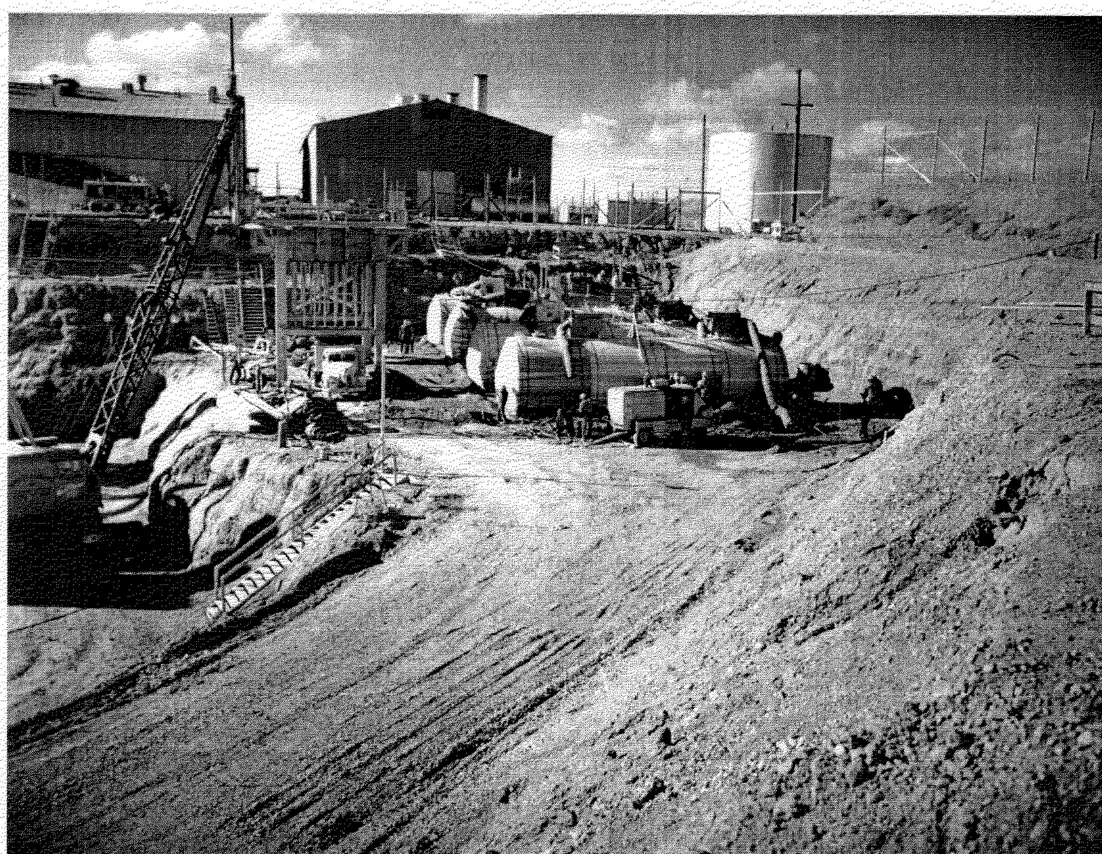

Figure F-6. 30,000-gal storage tanks.

During tank construction, no permanent method was installed to empty liquid from the 2 × 2 × 2-ft-deep sumps cast into the northeast corner of each concrete tank base slab. Instead, a portable steam jet pump was lowered through the sump riser into the sump for liquid removal. Once sump liquid was emptied, the portable jet pump was removed and the sump riser sealed. The liquid removed was routed through an abovegrade hose connection leading to Building CPP-619. Eventually permanent sump jet pumps were installed during the "1578" project.

Liquid removing jet pumps were permanently installed into each tank with lines penetrating through the tank personnel access, extending underground to strategic Tank Farm locations. The lines were not connected to existing Tank Farm waste processes or equipment during the initial construction but were temporarily capped for possible future uses.

The 30,000-gal tank system was originally designed to process special waste types (i.e., submarine reactor waste). The main Tank Farm was designed to process aluminum-clad waste. To prevent mixing special fuel waste with the standard aluminum-clad waste, the 30,000-gal tank system was built as a stand-alone system, segregated from the main Tank Farm. Once methods to combine different waste types were available in 1961, the original temporary line caps were removed during construction project "4016" and the 30,000-gal tank system was connected to the main Tank Farm.

In 1974 and 1975, high-level liquid waste contained within the 30,000-gal tanks was removed and the tanks were flushed with water. The tank system was not used again until 1982–83 when an emergency condensate collection point for the PEW Evaporator was needed. The tanks were then emptied to their heels, and the contents were transferred to Tank WL-102. In 1990, water was added to the tanks to allow RCRA sampling, and the remaining residue was deemed nonhazardous (WINCO 1994). The tanks again were emptied to their heels, and the contents were transferred to Tank WL-133. Tanks WM-103 through -106 and the associated piping are no longer used and isolated.

F-1.4 Construction Phase 4, WM-185 and WM-186 and Jet Pump Installation

Following the 4272 tank construction phase, the Waste Calcining Facility (WCF) was built as a pilot plant for a new "calcining" technology. The calcination process minimized waste volume by a factor of up to 10 to 1 by transforming radioactive liquid waste into a dry solid. Facilitators at INTEC accepted the calcining method, and the WCF began calcining operations following the 4272 project.

As a result of the calcining process, a permanent waste transfer system was required to move liquid waste from the 300,000-gal storage tanks to the WCF. However, only abovegrade transfer hoses, manual hookups, and temporary steam sources were available. Thus new jet pumps designed to provide a permanent means for transferring waste to the calcining facility were installed as part of the "5773" project in 1957. The main focus of this project, however, was to build two additional waste storage tanks (WM-185 and WM-186 and associated vaults CPP-785 and CPP-786) inside the Tank Farm.

Construction of Tanks WM-185 and WM-186 began with the excavation of the area north of WM-184 and east of WM-183 to bedrock. The construction of these two tank and vault systems paralleled the previous 4272 tank construction (WM-182 through WM-184) project. The construction included a 300,000-gal tank system enclosed in a pillar and panel vault system with north and south sump jets.

This construction phase permanently installed liquid removing steam jets (also called jet pumps) into Tanks WM-185, WM-186, and previously constructed Tanks WM-180 through WM-184. These jet pumps were located 3 to 9.5 in. (INTEC Drawings 106205 and 106207) above the tank floor. Permanent pumps were located 3 to 9.5 in. (INTEC Drawings 106205 and 106207) above the tank floor. Permanent steam lines were connected to each jet pump and routed through underground piping to steam sources within the Piping Control House (CPP-628). Double-contained process waste lines were routed underground from the jet pumps to the main transfer/filling system. The B series valve boxes were installed to consolidate some of the process waste line valves, primarily those associated with the tank-filling process waste lines. These valve boxes were installed to provide a means to transfer process waste between belowgrade storage tanks and the WCF. They were built as the tanks were constructed as the main transfer junction boxes on the Tank Farm transfer routes.

Not all process waste line valves were placed into the B series valve boxes. Each process waste pipeline associated with the storage tank was connected to separate flow control valves. The turning shaft and handle extend above grade level for manual manipulation. A protective sleeve surrounding the turning post was extended to grade surface. These valves were located inside the double-contained portion of the process piping. A double-contained pipe consists of two concentric pipes.

F-1.5 Construction Phase 5, WM-187 and WM-188

After the construction of the seven octagonal-vault-encased storage tanks, two more tanks were constructed, WM-187 and WM-188. Because of problems with leakage through the walls of the pillar-and-panel vaults, the type of vaults used to encase the remaining four 300,000-gal tanks was changed to a modified poured-in-place vault construction for Phases 5 and 6. With the exception of the vault roofs, the vaults in Phases 5 and 6 were entirely poured in place, similar to Tanks WM-180 and WM-181. The tanks in Phase 5 and 6 were placed adjacent to each other in square vaults (Vault CPP-713). The construction of these square vault-encased tanks began in 1958 with the excavation of the area east of Tank WM-186. The construction phase of Tanks WM-187 and WM-188 is referred to as the "5774" project.

The square concrete vault floors for both tanks were poured side by side on bedrock. Both floors were constructed with a 4-in. slope, beginning at the floor center and rising to the slab edge. The slope created a conical-shaped floor similar to the floor in the pillar and panel vaults. Two sump areas, 12 in. deep and 12 in. square, were cast within each vault floor for liquid drainage. These sumps were located at the northwest and southeast side for the WM-187 vault and northeast and southwest for the WM-188 vault. A 6 × 6-in. octagonal curb was installed inside the square vault. The curb creates an octagonal area 51 ft wide encircling a sand pad. The sand pad was designed to cushion the tank bottom.

The concrete vault walls were erected in three concrete pours (INTEC Drawing 106319). Each of the two 300,000-gal storage tanks was then assembled on the sand pad within the vault.

Waste transfer, cooling, decontamination, instrumentation, and vessel off-gas pipelines were then plumbed to the individual tanks and vaults. The waste transfer pipes running from the valve boxes to just outside the vault walls were encased in stainless steel pipe enclosures to prevent radioactive waste from contaminating the surrounding soils. Process waste line leaks were directed by the pipe encasements into the nearest valve box sump. Sump jets with permanently attached steam sources and transfer lines were installed into each vault sump to allow liquid removal.

Once the tanks, vaults, and plumbing were in place, the vault roof was installed, permanently enclosing the tank inside the vault. The moisture barrier was applied to the vault roof. The excavation pit was then backfilled to grade level, burying tanks, vaults, and process piping.

Liquid transfer jets were permanently installed inside the storage tanks through the tank risers to allow waste removal.

F-1.6 Construction Phase 6, WM-189 and WM-190

After the side-by-side installation of WM-187 and -188, the last two 300,000-gal tanks, WM-189 and WM-190, were installed. These tanks were placed in a square vault identical to the preceding vault and tank construction. These vaults were located east of, and adjacent to WM-187 and -188. This created a side-by-side four-tank configuration. Vault CPP-713 separates and encases tanks WM-187, WM-188, WM-189 and WM-190 in a "four-pack" configuration. The construction of these two square vault-encased tanks was completed in 1964. This construction phase is referred to as the "4112" project.

The WM-189 and -190 vault floors were installed on bedrock and attached adjacent to the existing WM-187 and -188 vault floors. The floors were constructed with a 4-in. sloping conical shape identical to that described in Phase 5. Two 36-in.-deep sumps and a 9-ft-deep drain trench were cast within the vault floors for liquid drainage. The sumps were located at the northwest and southeast side for WM-189 vault and northeast and southwest for WM-190 vault. The drain trench was located at the southwest and northwest vault corners for WM-189 and -190 respectively. A 6 × 6-in. octagonal curb was installed inside the square vault. The curb creates an octagonal area 51 ft wide encircling a sand pad. A sand pad was designed to cushion the tank bottom.

Waste transfer, cooling, decontamination, instrumentation, and vessel off-gas pipelines were then plumbed to the individual tanks and vaults. The waste transfer piping running from the valve boxes to just outside the vault walls was encased in stainless steel pipe enclosures to prevent radioactive waste from contaminating the surrounding soils. Process waste line leaks were directed via the pipe encasements into the nearest valve box sump.

After completion of the 5773 construction project, individual buried process waste valves began to fail (i.e., leaking, sticking open or closed). While the specific dates of valve failure are not known, several valves were repaired during the early 1970s (Machovec 1999). Repairing each valve required radiation shielding and excavation in soils that had been previously contaminated by spills (WINCO 1992). Liquid also began to accumulate inside the tank vaults. This accumulation of slightly contaminated vault liquids resulted from surface-water seepage (rainfall and snowmelt), vault condensation, and valve leakage. Premature reduction in waste storage capacity resulted because vault jet pumps could move liquid only from each vault to its respective storage tank. These issues were addressed during the C series valve box installation phase.

F-1.7 Construction Phase 7, C Series Valve Box Installation

Excavation to replace failing process valves continued as the Tank Farm continued operation. In 1975, the "1578" project was implemented to improve the waste transfer valve system. The project consisted of installing C series valve boxes, refurbishing older valves, rerouting pipes to valve boxes, and consolidating valves within the new valve boxes. This improved valve access, increased protection to workers from contaminated soils, and reduced repair costs by minimizing excavation. These valve boxes were built with drain lines that were designed to drain leaking liquids to a central location for transferred directly to the PEW Evaporator.

Before the C series valve box installation phase, vault sump liquid could be jetted only from the vault sump to the respective belowgrade storage tanks. As this jetting process continued, storage tank volume reserved for concentrated process waste began to decrease as more and more slightly contaminated vault liquid filled the tanks. A method employed to slow the increase in tank volume was to insert a temporary jet pump into the vault sump. The vault liquid was transferred to the PEW

Evaporator via an abovegrade flex hose. The slightly contaminated liquid was then concentrated through evaporation and placed into the 300,000-gal storage tanks.

Permanently installing an extra jet pump into the vault sump and routing underground liquid transfer lines to the PEW Evaporator solved storage tank capacity reduction issues. This project also permanently installed jet pumps into CPP-717-A through –D sumps. The liquid removed from the base slab sumps was transferred to the PEW Evaporator.

Radiation monitors were installed throughout the Tank Farm during the 1578 project. These monitors were installed to detect leaks within valve boxes or other enclosed areas. These monitors were connected to surface accessible junction boxes and inaccessible conduit duct banks, which routed to the Computer Interface Building (CPP-618).

To improve detection of possible system leaks and tank level accuracy, an enhanced liquid level monitoring system was installed in each tank during this phase. Before the improvement, the quantity of liquid waste transferred to a storage tank was difficult to determine because of the low accuracy of tank liquid level monitoring systems. Because the amount of waste sent to the storage tank could not be verified accurately, leaks within the Tank Farm would go unnoticed. The new liquid level detection system could detect a +/- 200-gal level change. The system enabled operators to verify the quantity of waste jetted out of or into a tank.

After the valve box and leak detection system were installed and buried, a watertight, 0.02-in.-thick, Dupont Polyolefin 3110 membrane was placed over the Tank Farm graded surface to prevent water ingress from the surface. The membrane was sandwiched between two 3-in. sand layers. The sand-Polyolefin-sand layers were then covered with 3 in. of gravel.

Around 1989, the radiation monitors installed during this C series valve box installation project were replaced with improved radiation monitors. This replacement provided for more accurate process waste leak detection in enclosed Tank Farm areas. The replacement was done as a stand-alone project before the Tank Farm upgrade, which is discussed below.

F-1.8 Construction Phase 8, Tank Farm Upgrade

Continued use and aging caused valves to fail. Valve failure allowed radioactive process waste to leak into associated valve boxes. Before Phase 8, the Tank Farm upgrade project, failed valves were manually replaced or repaired.

The Tank Farm upgrade project began in 1992 and was designed to reduce personnel radiation exposures. A different type of valve that could be remotely repaired was used. Workers could replace the valve cartridge from above using extension tools without entering the valve box.

The carbon-steel pressure relief discharge header connecting each Tank Farm tank to the exhaust stack had to be replaced because corrosion holes were found in the header. The header was disconnected from each tank condenser pit, capped, and abandoned in place. A new stainless steel relief discharge line was connected from each Tank Farm condenser pit to a newly installed header pipe leading to the atmospheric protection system (APS) "vent tunnel" ventilation system.

As part of this project and previous unstated minor upgrade projects, pipelines with inadequate secondary containment were replaced (i.e., capped and abandoned in place) and other pipelines were eliminated as needed (e.g., the 3-in. PUA-601 pipeline). Abandoned structures and debris were removed from north of CPP-604.

F-2. SOIL EXCAVATION AND SHORING

The installation of the Tank Farm tanks and subsequent construction phases required numerous ground excavation campaigns within the Tank Farm for vault, piping, and valve box installation. During excavation, various types of shoring devices such as wooden planking held in place with steel beams or a conjoining concrete spray maintained the initial grade of adjacent surfaces and prevented wall failure. Once work was completed, most shoring devices were abandoned and buried in place as the excavated areas were backfilled to grade level. The use of this technique was discontinued during the 1992 upgrade project (see Section F-1.8).

During remediation efforts, bore drilling into Tank Farm soils may be required for contaminant testing. As illustrated in Figure F-7, abandoned shoring devices could be encountered within the following Tank Farm areas:

- North and east of WM-180 and WM-181 because of WM-182, WM-183, and WM-184 tank construction
- North of WM-182 and WM-183 because of WM-103 through WM-106 tank construction
- East of WM-186 because of WM-187 and WM-188 tank construction
- Between WM-184 and CPP-604 because of WL-132 and WL-133 tank construction (located inside CPP-604)
- North of the CPP-708 stack because of stack reconstruction and enlargement.

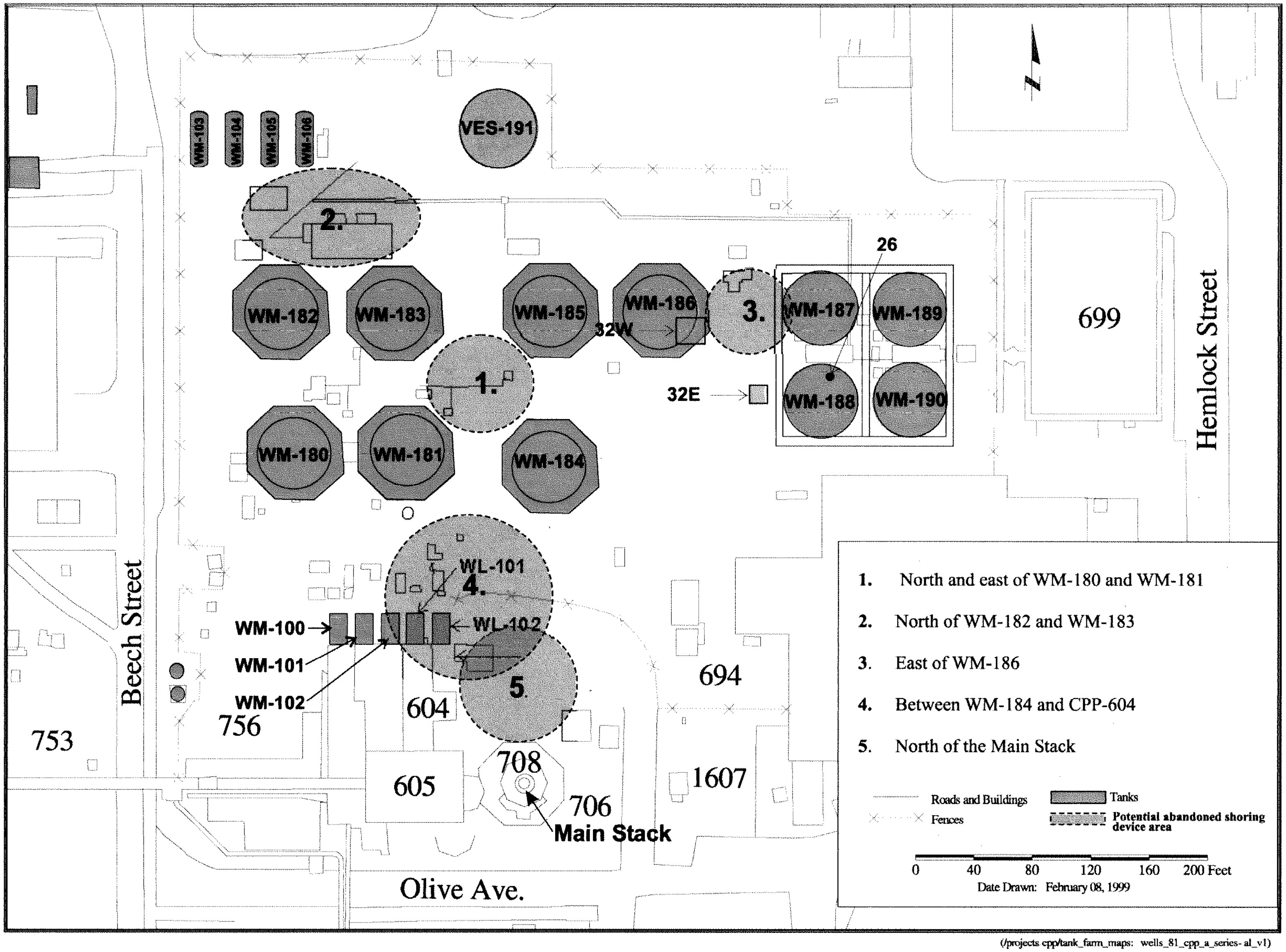

Figure F-7. Potential locations of abandoned shoring devices.

F-3. CONSTRUCTION DETAILS OF THE 300,000 AND 30,000-GAL TANKS

Details are provided in the following subsections of the construction of the eleven 300,000-gal (WM-180 through WM-190) and the four 30,000-gal (WM-103 through WM-106) tanks buried underground within the Tank Farm. Construction details such as tank and vault dimensions, capacity, construction materials, and other similar information are provided in the following subsections. Information about valve boxes and process waste pipelines is provided in this section and in Appendices A through D.

F-3.1 300,000-gal Tanks

The 300,000-gal storage tanks WM-180 through -190 are contained in belowgrade, unlined, octagonal (WM-180 through WM-186) or square (WM-187 through WM-190) concrete vaults. The tanks are stand-alone, stainless steel, cylindrically shaped vessels. Each tank is administratively limited to storing 285,000 gal of liquid waste. The inside tank diameter and wall height are 50 ft and 21 ft, with the exception of 23 ft for WM-180 and WM-181. The higher wall of those two tanks provides a storage capacity of 318,000 gal for each of the two tanks. Tanks WM-182 through -190 are constructed with an 11-in.-wide horizontal plate that connects the tank wall top to the dome. This horizontal plate provides a flat surface for process and instrumentation pipelines to penetrate the tank. Equally spaced gussets support the plate from underneath. Tanks WM-180 and WM-181 have no horizontal plate because the dome edge connects directly to the tank wall top. Tank domes are spherical in shape and rise above the tank wall from 8.5 to 8.7 ft.

Eight of the eleven 300,000-gal tanks contain stainless steel cooling coils (WM-180 through WM-185 and WM-187 through WM-190) to maintain the liquid waste temperature below 35°C for fluoride-containing waste and below 55°C for nonfluoride-containing waste. The liquid waste is maintained below these temperatures to minimize tank corrosion. The lower tank temperature also reduces the liquid surface evaporation rate, which in turn reduces condensation in the buried condenser off-gas lines. Demineralized water in the cooling coils along with chromate additives circulates through a closed system and is cooled by secondary cooling water.

Access to the 300,000-gal tanks is provided through risers. Each tank has four to five 12 in.-diameter risers. Tanks WM-184 through WM-190 also have one of two 18-in. risers. Most risers have equipment installed in them such as radio frequency probes for level measurement, corrosion coupons, or waste transfer equipment (steam jets and air lifts). Two steam jets are located inside each tank with the exception of WM-189 and WM-190, each of which has one steam jet and one air lift pump. A single steam jet can transfer waste out of a tank at approximately 50 gpm, and an air lift can transfer waste out of a tank at approximately 35 gpm. Table F-1 provides general information on the 300,000-gal tanks. Table F-2 provides general information on the 30,000-gal tanks.

F-3.2 30,000-gal Tanks

The 30,000-gal storage tanks (WM-103 through WM-106) were built between the summers of 1954 and 1955. Each tank has a total volume of 30,750 gal and are horizontal cylinders with American Society of Mechanical Engineers (ASME) dished heads attached on both ends. General information and tank dimensions are found in Table 2-6 of Section 2 of the Work Plan.

All four tanks contain stainless steel closed loop recalculating cooling coils to maintain the liquid waste temperature, the evaporation rate, and condensation accumulation. Base slab sump access is

Table F-1. Design information summary for 300,000 tanks.[a]

	WM-180	WM-181	WM-182	WM-183	WM-184	WM-185	WM-186	WM-187	WM-188	WM-189	WM-190
Design organization	Foster-Wheeler	Foster-Wheeler	Blaw-Knox	Blaw-Knox	Blaw-Knox	Fluor Corp.	Fluor Corp.	Fluor Corp.	Fluor Corp.	Fluor Corp.	Fluor Corp.
Tank subcontractor	Chicago Bridge & Iron (CBI)	CBI	CBI	CBI	CBI	CBI	CBI	Hammond Iron	Hammond Iron	Industrial Contractors	Industrial Contractors
Years constructed	1951--52	1951--52	1954–55	1954–55	1954–55	1957	1955–57	1958–59	1958–59	1964	1964
Initial service date	1954	1953	1955	1958	1958	1959	1962	1959	1963	1966	Spare
Design codes	Unknown	Unknown	API-12C	API-12C	API-12C	API-12C	API-12C	API-12C	API-12C	API-650	API-650
Cooling coils	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Tank diameter (feet)	50	50	50	50	50	50	50	50	50	50	50
Tank height to springline (feet)	23	23	21	21	21	21	21	21	21	21	21
Tank capacity (gallons)	318,000	318,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
Lower tank thickness (inches)	0.3125	0.3125	0.3125	0.3125	0.3125	0.3125	0.3125	0.3125	0.3125	0.3125	0.3125
Upper tank thickness (inches)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Corrosion allowance (mils)	Unknown	Unknown	125	125	125	125	125	125	125	125	125
Type of stainless steel	347	347	304 L	304 L	304 L	304 L	304 L	304 L	304 L	304 L	304 L
Design specific gravity	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4

Physical Characteristics	**Dimensions**	
Dome height	8.5 ft (WM-182 through WM-190) – 8.7 ft (WM-180 and –WM181)[a]	
Approximate total tank volume	2,000 yd^3 [a,b,c]	1,825 yd^3 [a,b,d]
Approximate dome volume	330 yd^3 [a,c,e]	300 yd^3 [a,e,d]

a. Values shown in table are approximations to aid in cost estimation and provide a general tank description.

b. Estimated volume is based on the tank dimensions not the tank capacity.

c. Calculated volume for Tanks WM-180 and -181.

d. Calculated volume for Tanks WM-182 through 190.

e. Volume calculated using standard spherical cap equation, a diameter of 50 ft, and appropriate dome height.

Table F-2. Design information summary for 30,000-gal tanks.

Tank Identification Number	WM-103	WM-104	WM-105	WM-106
Design organization	Blaw – Knox Company	Blaw – Knox Company	Blaw – Knox Company	Blaw – Knox Company
Vendor	Alloy Fabricators	Alloy Fabricators	Alloy Fabricators	Alloy Fabricators
Years constructed	1954–1955	1954–1955	1954–1955	1954–1955
Total tank volume	30,750 gal[a]	30,750 gal[a]	30,750 gal[a]	30,750 gal[b]
Tank cylindrical length	38 ft[a]	38 ft[a]	38 ft[a]	38 ft[b]
Cylindrical heads (two per tank)	ASME Standard Flanged and Dished Heads (~2 ft deep)[a]	ASME Standard Flanged and Dished Heads (~2 ft deep)[a]	ASME Standard Flanged and Dished Heads (~2 ft deep)[a]	ASME Standard Flanged and Dished Heads (~2 ft deep)[b]
Total tank length (feet)	42	42	42	42
Tank inner diameter (feet)	11.5[a]	11.5[a]	11.5[a]	11.5[b]
Tank wall thickness (inches)	11/16[a]	11/16[a]	11/16[a]	11/16[b]
Tank supporting base slab size	47.5 × 17 × 1.25 ft thick[c]	47.5 × 17 × 1.25 ft thick[c]	47.5 × 17 × 1.25 ft thick[c]	47.5 × 17 × 1.25 ft thick[c]
Liquid containment perimeter curb size	12 in. high × 9 in. wide[c]	12 in. high × 9 in. wide[c]	12 in. high × 9 in. wide[c]	12 in. high × 9 in. wide[c]
Tank access risers	Three 6-in. diameter One 3-in. diameter[c]	Three 6-in. diameter One 3-in. diameter[c]	Three 6-in. diameter One 3-in. diameter[c]	Three 6-in. diameter One 3-in. diameter[c]
Sump riser (concrete pipe)	24-in. diameter Pipe wall is 3 in. thick[c]	24-in. diameter Pipe wall is 3 in. thick[c]	24-in. diameter Pipe wall is 3 in. thick[c]	24-in. diameter Pipe wall is 3 in. thick[c]
Sump dimensions	2 × 2 × 2 ft[c]	2 × 2 × 2 ft[c]	2 × 2 × 2 ft[c]	2 × 2 × 2 ft[c]
Buried tank depths (dimensions to tank bottom)	28.5 ft[c]	29 ft[c]	29.5 ft[c]	29.5ft[c]

a. Drawing 104807.

b. Drawing 104809.

c. Drawing 105027.

F-4. TANK VAULT DETAILS

F-4.1 Vaults CPP-780 through CPP–786 and CPP-713

Each 300,000-gal storage tank is enclosed in a concrete vault. The vaults vary in design from square to octagonal shapes, but all are constructed of reinforced concrete (see Table F-3 for general physical information about the tank vaults). The enclosing vaults and respective underground storage tanks include the following:[a]

- Monolithic octagonal vaults (i.e., CPP-780 and –781) enclose Tanks WM-180 and WM–181, respectively
- Pillar and panel octagonal vaults (i.e., CPP-782 through –786) enclose Tanks WM-182 through WM–186, respectively
- Monolithic square vaults (i.e., CPP-713) enclose Tanks WM-187 through WM–190.

Each vault floor is cast with liquid draining sumps varying in size and capacity. The number of sumps per vault and the respective capacities include the following:

- Vaults for WM-180 and -181 each contain one leak detection sump (120 gal)
- Vaults for WM-182 through -188 each have two hot sumps (7.5 gal each)
- Vaults for WM-189 and -190 each have two hot sumps (22.5 gal) and one larger cold sump (1,011 gal).

Cold sumps collect rainwater, snowmelt, or surface water infiltration (Tanks WM-189 and WM-190). Hot sumps collect leaking tank waste. Each sump is equipped with a liquid-level sensor that detects leakage into a vault. Each vault sump has transfer jets that empty the sump contents at 20 gpm to the PEW Evaporator feed collection tanks in CPP-604 (WL-102, and WL-133) or back into the tank

enclosed by the vault. Vault sumps for Tanks WM-180 and WM-181 can be emptied to the alternate tank but not back to the tank enclosed by the vault. The 6-in.-thick concrete vault roofs are covered with approximately 10 ft of soil for radiation protection of personnel.

a. Tanks WM-103 through WM-106 were not placed inside a vault but buried directly in the ground.

Table F-3. Design information summary for Vaults CPP-780 through CPP-786 and CPP-713.

	CPP-780	CPP-781	CPP-782	CPP-783	CPP-784	CPP-785	CPP-786	CPP-713			
	WM-180	WM-181	WM-182	WM-183	WM-184	WM-185	WM-186	WM-187	WM-188	WM-189	WM-190
Design organization	Foster-Wheeler	Foster-Wheeler	Blaw-Knox	Blaw-Knox	Blaw-Knox	Flour Corp.	Flour Corp.	Flour Corp.	Flour Corp.	Flour Corp.	Flour Corp.
Years constructed	1951–52	1951–52	1954–55	1954–55	1954–55	1957	1955–57	1958–59	1958–59	1964	1964
Vault type	Cast-in-place monolithic octagonal	Cast-in-place monolithic octagonal	Pillar and panel octagonal	Pillar and panel octagonal	Pillar and panel octagonal	Pillar and panel octagonal	Pillar and panel octagonal	Cast-in-place monolithic square	Cast-in-place monolithic square	Cast-in-place monolithic square	Cast-in-place monolithic square
Vault roof shape	Pyramidal[1]	Pyramidal[1]	Flat[2]	Flat[2]	Flat[2]	Flat[3]	Flat[3]	Flat[4]	Flat[4]	Flat[5]	Flat[5]
Inside width	56 ft[1]	56 ft[1]	58.9 ft[6]	58.9 ft[6]	58.9 ft[6]	58.8 ft[7]	58.8 ft[7]	56 ft[18]	56 ft[8]	56 ft[8]	56 ft[8]
Wall thickness	2.33 or 1.75 ft[1]	2.33 or 1.75 ft[1]	0.5 ft[9]	0.5 ft[9]	0.5 ft[9]	0.542 ft[10]	0.542 ft[10]	N[1] = 3.5 ft S = 3.5 ft W = 1.5 ft E = 3.5 ft[11]	N[1] = 3.5 ft S = 3.5 ft W = 1.5 ft E = 3.5 ft[11]	N[1] = 3.5 ft S = 3.5 ft W = 3.5 ft E = 1.5 ft[11]	N[1] = 3.5 ft S = 3.5 ft W = 3.5 ft E = 1.5 ft[11]
Inside vault wall height	27.33 ft[12]	27.33 ft[12]	32 ft[6,9]	32 ft[6,9]	32 ft[6,9]	29.5 ft[13]	29.5 ft[13]	32.6 ft[14]	32.6 ft[14]	32.6 ft	32.6 ft
No. of Vault risers and sumps	1[15]	1[15]	2[16]	2[17]	2[18]	2[19]	2[20]	2[21]	2[22]	3[23]	3[24]
Maximum roof thickness	5.75 ft[1]	5.75 ft[1]	3.66 ft[25]	3.66 ft[25]	3.66 ft[25]	3.5 ft[26]	3.5 ft[26]	4.5 ft[27]	4.5 ft[27]	4 ft[28]	4 ft[28]
Minimum roof thickness	1.25 ft[4]	1.25 ft[4]	0.5 ft[29]	0.5 ft[29]	0.5 ft[29]	0.5 ft[26]	0.5 ft[26]	0.5 ft[30]	0.5 ft[30]	0.5 ft[28]	0.5 ft[28]
Vault top to grade	6.75 ft[31]	6.75 ft[31]	8.5 to 9 ft[32,33]	9 to 9.5 ft[32,33]	9 ft[32]	9 ft[34]	9 ft[34]	9 ft[27]	9 ft[27]	9 ft[28]	9 ft[28]
Total vault volume[7]	3,386 yd^3	3,386 yd^3	3,229 yd^3	3,229 yd^3	3,229 yd^3	3,229 yd^3	3,229 yd^3	3,737 yd^3	3,737 yd^3	3,737 yd^3	3,737 yd^3
Vault volume with tank in vault[7]	1,384 yd^3	1,384 yd^3	1,404 yd^3	1,404 yd^3	1,404 yd^3	1,404 yd^3	1,404 yd^3	1,911 yd^3	1,911 yd^3	1,911 yd^3	1,911 yd^3

N = North; S = South; W = West; E = East.

1. INTEC Drawing 1033628.
2. INTEC Drawing 105588.
3. INTEC Drawing 106218.
4. INTEC Drawing 106238.
5. INTEC Drawing 117967
6. INTEC Drawing105587
7. INTEC Drawing106216
8. INTEC Drawing106311
9. INTEC Drawing105590
10. INTEC Drawing 106221
11. INTEC Drawing 106308 and 106311
12. INTEC Drawing103362
13. INTEC Drawing 106220 and 106217
14. INTEC Drawing106310
15. INTEC Drawing 103557
16. INTEC Drawing 105458
17. INTEC Drawing 105460
18. INTEC Drawing 105528
19. INTEC Drawing 106210
20. INTEC Drawing 106226
21. INTEC Drawing 106237
22. INTEC Drawing 106249
23. INTEC Drawing 117958
24. INTEC Drawing 117960
25. INTEC Drawing 105593
26. INTEC Drawing 106219
27. INTEC Drawing 106309
28. INTEC Drawing 119769
29. INTEC Drawing 105588
30. INTEC Drawing 106314
31. INTEC Drawing 103557
32. INTEC Drawing 105582
33. INTEC Drawing 105057
34. INTEC Drawing 106223

The various tank and vault designs have different abilities to withstand a seismic event. Studies (AEC 1991a; EQE 1988; AEC 1991b, 1993b; EQE 1994; Malik and Bolourchi 1993) were performed to determine whether the vaults and tanks would meet seismic criteria set forth by DOE Standard DOE-STD-1020 and DOE-ID architectural and engineering standards (DOE-ID 1999b). The cast-in-place monolithic octagonal vaults (WM-180 and WM-181) have been qualified through analytical modeling to meet the seismic criteria (AEC 1991b). The cast-in-place monolithic square vaults (WM-187 through WM-190) are believed to meet seismic criteria but were not tested (Swenson 1999). The pillar-and-panel octagonal vaults (WM-182 through -186) may not qualify.[b]

An engineering study (Blume & Associates 1990) was performed to evaluate the effects of various loads on the Tank Farm vaults. The study was initiated because of a specific concern that large cranes, multiple trucks, personnel, or other equipment placed within the Tank Farm could damage or collapse the Tank Farm vaults. Vault damage would most likely cause damage to the tank contained inside. Based on this study, load limits were established for vehicular loads within the Tank Farm to ensure the vaults were not overstressed. Before entry into the Tank Farm, load configurations that could exceed limits specified by established load studies must be evaluated to ensure vault damage does not occur. None of the tank vaults meets current Uniform Building Code static loading criteria (AEC 1993a).

F-4.2 Valve Box Construction

Valve boxes, located were pipe runs change directions, were constructed to provide protection for pipe joints, improve valve access, increase protection to workers from contaminated soils and reduce valve repair costs by minimizing ground excavation. Valve boxes were installed with sumps and attaching drain lines to transfer liquid waste to vault sumps or the PEW Evaporator (CPP-604 via DVB-WM-C12) in the event pipe encasement draining or process valve leaking occurs.

Each concrete valve box is reinforced and lined with stainless steel. The interior surfaces of C series valve boxes were painted. Americoat 33, an enamel based paint, was used to paint C series valve boxes. Bitumastic #50, a material similar to tar thatch, was used as filler around pipe sleeves or on carbon steel piping. The approximate valve box dimensions are 6 ft long, 6 ft wide, and 6.5 ft high with a wall thickness of 0.5 ft. Typically, valve boxes extend approximately 1 ft abovegrade (INTEC Drawings 377819, 137961, and 137929).

Valve boxes were constructed within the Tank Farm area in groups or series. Series A and B valve boxes were installed in the 1950s and 1960s during the initial 300,000-gal liquid storage tank construction. Series C and D valve boxes were installed in 1975 to provide easier access to process waste valves.

More detailed information concerning individual valve boxes associated with the Tank Farm can be found in Appendices A and B.

---

b. Initially none of the tank vaults passed a seismic analysis. Later, a more refined analysis was performed to show that two of the 11 vaults met the current requirements. Such a refined analysis was planned for the remaining nine vaults, but was canceled because of a lack of funding. It was thought that they also could pass; however, an analysis was not performed. In addition, today's seismic requirements would be less stringent then those against which the original analysis was performed. The original analysis was performed to an equivalent safety hazards analysis performance category (PC) of PC-4. Today, such analyses would require use of PC-3 criteria.

F-5. PROCESS WASTE PIPELINES

A general overview of process waste pipe systems associated with the Tank Farm is presented in this section. Each pipeline within the Tank Farm has been given a unique identifier, or name (e.g., 1-1/2" WRA-601 or 3" PUA-604). (More detailed information about individual process waste pipelines associated with the Tank Farm can be found in Appendices C and D.) Recent efforts to conform to updated pipe identification codes transformed original pipeline identification names in two ways:

- Different letters were used to represent the same original pipe system (e.g., 1-1/2" WRA-601 was changed to 1-1/2" CRA-601)

- The original three-digit PIN[c] was changed to a six-digit PIN.

The first three digits of the six-digit PIN were assigned by INTEC configuration administrators, and the last three digits consisted of the original three-digit PIN (e.g., the 3" WRN-661 was changed to the 3" PLN-152661). These and other pipeline identification changes[d] have caused confusion and difficulty in comparing individual pipelines to original and more recent pipe drawings. All lines that transport waste within the Tank Farm are buried and enclosed in pipe encasements for secondary containment. The four main types of Tank Farm secondary containment include the following:

- Split tile (ceramic cast pipe)

- Concrete troughs lined with stainless steel

- Direct buried pipes in concrete

- Double-walled stainless steel pipe.

During recent Tank Farm upgrades, most pipe sections encased in split tile were either replaced or abandoned in place (Swenson 1990).[e] Process waste lines and respective secondary containment are generally covered with 10 to 15 ft of soil.

Initially, pipelines transferred high-level liquid waste directly to one of the 300,000-gal storage tanks or to tanks WM-100 through WM-102 (inside CPP-604). As discussed in Sections 2.1 and 2.2.1, the high-level waste generating processes have ceased, and the lines from these processes to the tanks have been capped. Concentrated PEW Evaporator bottoms are directed to Tank WL-101 (inside CPP-604) for temporary storage and then transferred to one of the 300,000-gal storage tanks.

---

c. Pipeline identification number (PIN) is given to piping to distinguish it from other piping of the same classification (e.g., PUA and LAA) and diameter.

d. Original Tank Farm pipelines were given three different pipeline identifier names as they entered a building. The first name represented the pipeline exterior to the building, the second pipe name represented the pipeline inside the building wall, and the third pipe name represented the pipe interior to the building. This naming practice was eventually discontinued. Pipeline identifier names are now continuous even though building walls are penetrated.

e. With this type of secondary containment, leaking acidic waste could eat through the mortar used to attach and seal sections of the split tile piping, compromising the secondary containment. Most of the tile encased pipes were replaced or abandoned. However, short sections of pipe encased in tile still remain on active fill lines for WM-180 and WM-181 but cannot be used unless authorized by upper management.

Any fluid leaking from a process line drains into an encasement and then into a valve box or vault sump. Leaking liquid is detected by radiation and tank level detection instrumentation. A leaking line is immediately taken out of service and is not reused until it has been repaired. Waste collected in a valve box or vault sump is jetted to Tank WL-133 (located in building CPP-604) or drained to Valve Box C12. Waste collected in Valve Box C12 also is jetted to Tank WL-133. Waste from WL-133 is sent to the PEW Evaporator for processing.

F-5.1 Process Waste Pipeline Investigation

As part of the development of the OU 3-14 RI/FS Work Plan, all known pipelines within the Tank Farm and crossing the Tank Farm perimeter were evaluated. During the pipeline investigative process, all known individual underground Tank Farm process waste pipelines were located and identified to provide information about pipelines that could be environmental release sources.

No previously undocumented potential release sites associated with process waste pipelines were identified based on the investigation of process waste pipelines within and crossing the Tank Farm perimeter.

The pipeline investigation was conducted in two phases. The first phase investigated process waste pipelines contained within the Tank Farm perimeter. The first phase used piping and instrument drawings (P&IDs) to identify pipe origins and terminations for all underground process waste pipelines not contained within structures (i.e., tank vaults and valve boxes). Official underground utility drawings (UUDs) were not used in this phase because drawing credibility became questionable relative to drawing inconsistencies found between corresponding adjacent drawings, inaccurate as-built representation, and pipeline placement and location (Mace 1998).

The second phase investigated process waste pipelines crossing the Tank Farm perimeter. The second phase included pipelines coming from buildings, valve boxes, manholes, or other pipelines located outside the Tank Farm that transfer process and service waste back and forth across the Tank Farm perimeter.

Plan-view UUDs were required to determine Tank Farm perimeter pipeline crossing locations and respective pipe identification, notwithstanding the drawing credibility issues. When the underground drawings were not explicit about origin, termination, or location, additional information was obtained by interviewing the Tank Farm systems engineers, reviewing valve box details, and reviewing improved UUDs produced by the Facility Drafting Department. While improved UUDs are not officially released, they were helpful to verify and supplement the current official UUDs.

The depth of the underground pipelines at the Tank Farm ranges from 4 to 43 ft. Electrical, steam, and air lines are buried down to a depth of 8 ft, and process pipelines are buried to a depth of 15 ft, with the exceptions of the berm area north of CPP-604, under which the depth of the process lines is 43 ft, and in the vicinity of Tanks WM-180 and WM-181, where the process lines are buried at a depth of about 20 ft.

Information obtained in the investigation is summarized in Appendices C and D. The information includes pipe identification numbers, descriptions, origin and termination locations with drawing references, estimated pipeline secondary containment types, pipeline material and additional information, and comments specific to a pipeline.

Though an attempt was made to identify all process waste piping contained within and crossing the Tank Farm perimeter, information from these investigations was only as accurate as the currently available drawings. Because current available pipe drawings are imperfect,[f] unknown abandoned lines may still exist within the Tank Farm. Future studies may include comparing the most recent P&IDs with later revisions to determine which pipelines were added or removed since the Tank Farm inception.

f. Pipeline drawing accuracy will be improved once official underground utility drawings (UUDs) are upgraded in accordance with the improved UUDs of the Facility Drafting Department

F-6. REFERENCES

AEC, April 1991a, *Preliminary Seismic Evaluation of Post and Panel Waste Tank Vaults WM-182 to WM-186,* Advanced Engineering Consultants, Inc.

AEC, August 1993a, *Evaluation of Existing Vaults for Vehicle Loads; HLWTFR Project*, Job Number 1002-08, Advanced Engineering Consultants, Inc.

AEC, February 1991b, *Seismic Analysis and Evaluation of Octagonal Waste Tank Vaults WM-180 & WM-181 at the Idaho Chemical Processing Plant*, Job Number 0129, Advanced Engineering Consultants, Inc.

AEC, March 1993b, *Addendum to Chapter 4 of 'Seismic Analysis and Evaluation of Waste Tank Vaults WM-180 & WM-181 and WM-187 through WM-190 at the Idaho Chemical Processing Plant, Idaho National Engineering Laboratory,' August 1990*, Advanced Engineering Consultants, Inc.

Blume & Associates, October 1990, *Seismic Analysis and Evaluation of Waste Tank Vaults WM-180 & WM-181 and WM-187 through WM-190 at the Idaho Chemical Processing Plant Idaho National Engineering Laboratory*, John A. Blume & Associates, Engineers.

DOE-ID, October 1999a, Final Scope of Work for the Waste Area Group 3, Operable Unit 3-14, Tank Farm Soil and Groundwater, Remedial Investigation/Feasibility Study," DOE/ID-10653, Rev. 0, U.S. Department of Energy, Idaho Operations Office.

DOE-ID, 1999b, *DOE-ID Architectural Engineering Standards*, website at http://www/resources/aem/eaesthome.html, U.S. Department of Energy, Idaho Operations Office.

EQE, March 1994, *Independent Review of Additional Seismic Analysis and Evaluation of Tanks WM-180 & WM-181 and WM-187 through WM-190*, Job Number 52123.06, EQE International.

EQE, November 1988, *Seismic Evaluation of Waste Tank Vaults at the Idaho Chemical Processing Plant*, EQE International.

INTEC Drawing 103362, Bechtel BWXT Idaho, LLC.

INTEC Drawing 106205, Bechtel BWXT Idaho, LLC.

INTEC Drawing 106207, Bechtel BWXT Idaho, LLC.

INTEC Drawing 106319, Bechtel BWXT Idaho, LLC.

INTEC Drawing 137929, Bechtel BWXT Idaho, LLC.

INTEC Drawing 137961, Bechtel BWXT Idaho, LLC.

INTEC Drawing 377819, Bechtel BWXT Idaho, LLC.

Mace, G. K., October 8, 1998, Interdepartmental Communication, to D. E. Judy, "INTEC Tank Farm," GKM-01-98, Lockheed Martin Idaho Technologies Company.

Machovec, D. C., June 16, 1999, Interdepartmental e-mail to P. A. Tucker, Lockheed Martin Idaho Technologies Company.

Malik, L., and Bolourchi, S., August 1993, *Evaluation of Existing Vaults for Vehicle loads, HLWTFR Project,* Advanced Engineering Consultants, Inc., San Francisco, California.

Swenson, M. C., April 21, 1999, Interdepartmental e-mail to P. A. Tucker, "Seismic qualification of 300,000-gal tanks," Lockheed Martin Idaho Technologies Company.

Swenson, M. C., August 24, 1990, Interdepartmental Communication to W. B. Palmer, *Tank Farm RCRA Assessment*, MCS-04-90, Westinghouse Idaho Nuclear Company, Inc.

WINCO, February 28, 1992, WINCO Environmental Restoration, ICPP Environmentally Controlled Areas Reference Guide, Westinghouse Idaho Nuclear Company, Inc.

Appendix G

Investigation of Potential Environmental Release Sites

Appendix G

Investigation of Potential Environmental Release Sites

To provide information about known and previously undocumented Tank Farm potential release sites, documented and anecdotal information about release sites was gathered and reviewed for the Work Plan as part of an investigation conducted by Facility Engineering from July to November 1998. The documented information comprised supervisors' daily logs, occurrence reports, and other published reports. The anecdotal information was generated from interviews that were conducted with current and former INEEL employees knowledgeable about the Tank Farm. The discovery of nine previously undocumented potential releases within the Tank Farm boundaries, as defined by the draft OU 3-14 Scope of Work (DOE-ID 1999), resulted from the investigation of documented and anecdotal information. The nine potential release sites are described in the subsections below and summarized in Table G-1.

The documented and anecdotal information was compared with previously documented environmentally controlled areas (ECAs). An ECA is a CERCLA-controlled area in which an environmental release occurred or could have occurred. Environmental release sites not corresponding with documented ECAs were identified as potential environmental release sites.

G-1. INVESTIGATION OF DOCUMENTED INFORMATION

Documented information such as supervisors' daily logs, occurrence reports, and published reports, such as the H.L. Lord report (see Appendix E), were generated from the inception of Tank Farm operations to the present day. This information recorded environmental releases throughout the Tank Farm history. Each documented environmental release site was examined and compared with known ECAs. The investigation resulted in the discovery of four previously undocumented release sites. The results are discussed in the following subsections.

The supervisor's daily logs, occurrence reports, and published reports were used to aid in documenting the historical information compiled in Section 3 of the work plan. This information was derived from the Track 1 and the Track 2 studies. The information fed the RI/BRA, 3-13 RI/FS and the 3-13 ROD. In turn, that information was used not only to guide the Phase I sampling and logging effort, but also aided in the determination that further characterization was needed due to the lack of specific information about each site.

G-1.1 Supervisors' Daily Logs

From the inception of operation of the Tank Farm, supervisors have kept a daily record of facility operations and maintenance in logbooks. The information recorded in the logbooks allows supervisors to track Tank Farm activities, plan work activities, and verify task completion. The historical information contained within the logbooks can provide information in determining environmental release sites within the Tank Farm not previously documented as ECAs.

Original logbook entries are located in the INTEC Nuclear Operations Records Library. An estimated 12,000 hand-written pages have been recorded on microfiche for lifetime retention and review. Examination difficulties because of illegible hand-written entries, blurred microfiche, and time limitations confined this investigation to approximately 300 microfiche pages. Further logbook investigation could potentially uncover additional environmental releases not previously identified as ECAs or determined by this investigation.

Table G-1. Previously undocumented potential environmental releases at the Tank Farm.

Tank Farm Potential Environmental Release Location	Occurrence Description	Occurrence Date	Environmental Release Substance	Remedial Actions	Reference	Comments
Between CPP-635 and CPP-636	Severed steam line	August 25, 1977	Steam (possible unknown contaminants such as chromates). Unknown volume or quantity.	Unknown	WCF Supervisor's Logbook, August 25, 1977, p. 33	See Appendix E for original logbook pages.
CPP-605 building entrance	Jet discharge line for WL-135 inside NWCF leaking condensate (NO_x) because of incomplete butt weld.	December 1, 1997	NO_x condensate solution. Two small puddles formed on the ground with less than a significant fraction of reportable quantity.	Removed contaminated gravel and soil.	Occurrence Report #IDLITC-WASTEMGNT-1997-0026	See Appendix E for original logbook pages.
Within the excavated area north of CPP-604.	During excavation for low level waste tanks WL-132 and WL-133, soil contamination was discovered north of CPP-604.	1980s	Radionuclides. Unknown volume or quantity.	Unknown remediation actions. Excavated areas were back filled using soils with contact readings less than 5mR/hour. Contaminated soils may have been removed during the High Level Waste Tank Farm Replacement Project.	H.L. Lord Report, 3-25-92, HLL-02-92, "Description of Known Contamination in the ICPP High Level Waste Tank Farm"	A copy of the H. L. Lord report is located in Appendix E.
Bottom of Valve Box A2	During excavation for low level waste Tanks WL-132 and WL-133, soil contamination was discovered near the bottom of Valve Box A2 (on the south side).	1980s	Radionuclides. Unknown volume or quantity.	Unknown remediation actions. Contaminated soils may have been removed during the High Level Waste Tank Farm Replacement Project.	H.L. Lord Report, 3-25-92, HLL-02-92, "Description of Known Contamination in the ICPP High Level Waste Tank Farm"	A copy of the H. L. Lord report is located in Appendix E.

Table G-1. (continued).

Tank Farm Potential Environmental Release Location	Occurrence Description	Occurrence Date	Environmental Release Substance	Remedial Actions	Reference	Comments
Area between WM-191 and WM-106	Area was used to decontaminate construction equipment before WM-191 was constructed.	Before 1970	Steam condensate, decontamination solution, petroleum products, and radioactive contaminates. Unknown volume or quantity.	Excavated area for WM-191 construction but no contamination was found.	F.S. Ward Interview	Though this area may have been used to decontaminate construction equipment, no contamination was found during WM-191 construction. See Appendix E for original interview notes.
Ground surface north of WM-187 and WM-189	Hydraulic oil spill from a P & H construction crane.	Between 1986 and 1988	1 to 10 gal of hydraulic oil.	Hydraulic oil was left on the ground covered with a plastic sheet and gravel.	F.S. Ward Interview	See Appendix E for original interview notes.
Tank Farm surface area.	Abovegrade hose connection leaks while transferring vault liquid to PEW Evaporator.	Before 1975	Water with slight radioactive contamination. Unknown volume or quantity.	No remediation actions	F.S. Ward Interview	See Appendix E for original interview notes.
Adjacent to condenser pit CPP-387 and northwest of CPP-635	Chromate solution leak from two failed buried valves WRV-1 and WRV-2 (valve names may have changed to WRV-WM-1 and 2).	Before 1977	Chromate solution. Unknown volume or quantity	Unknown remediation actions, area was excavated for Valve Box C20.	F.S. Ward Interview	See Appendix E for original interview notes. Valves are now located inside Valve Box C20
North of CPP-635 in a dirt bottom valve box (valve box has no name)	Chromate solution leak from a failed valve WSV-6 located inside a dirt bottom valve box.	Before 1977	Chromate solution. Unknown volume or quantity	Unknown past remediation actions, area is tested periodically no contamination found	F.S. Ward Interview	See Appendix E for original interview notes.

One log entry was found during the examination of the 300 microfiche pages that may indicate a potential environmental release site not previous recorded. The log entry describes a severed steam line located between CPP-635 and CPP-636. The exact steam line location and amount of escaping steam was not recorded in the log entry. A copy of the original log entry is provided in Appendix E.

G-1.2 Occurrence Reports Investigation

Occurrence reporting informs DOE and LMITCO management, on a timely basis, of events that could adversely affect national security; the safeguards and security interests of DOE; the health and safety of the public and workers or the environment; the intended purpose of DOE facilities; or the credibility of the DOE and LMITCO (Management Control Procedure [MCP] -190). An occurrence is an event or a condition that adversely affects, or may adversely affect, DOE or contractor personnel, the public, property, the environment, or the DOE mission as defined by the criteria threshold identified in DOE M 232.1-1A. Examples of documented occurrence reports include the following:

- Personnel exposure
- Soil contamination
- Fire alarms
- Power outages
- Procedure violations.

An occurrence report is initiated when a significant event, as defined in DOE M 232.1-1A, occurs. The responsible manager reports this event to the plant shift manager. The plant shift manager interviews the personnel involved and determines whether the event meets occurrence reporting criteria as defined by DOE Order O 232.1A. If an occurrence report is required, the plant shift manager files a "Notification of Occurrence" to DOE-ID within a timely manner. The responsible manager is given 45 days to document the occurrence and provide methods for preventing recurrence. Once the report is complete and accepted by the plant shift manager, it is given to DOE-ID for evaluation and approval. After the report has been approved, it is given to DOE-Headquarters for a second evaluation and approval. Once the report is accepted, the occurrence report is then filed with the Office of the Deputy Assistant Secretary for Safety, Health, and Quality Assurance and placed within the INTEC Information Center located in CPP-665. If the occurrence report is rejected, the responsible manager is given 21 days to modify the report in accordance with suggested resolutions and resubmit for approval.

Because occurrence reports are filed with the Office of the Deputy Assistant Secretary, all recent occurrence reports are given a permanent lifetime retention or an 80-year retention status. Permanent lifetime retention status is provided for occurrence reports of widespread public and congressional interest. An 80-year retention status is provided for any other occurrence report filed with the Office of the Deputy Assistant Secretary (DOE M 232.1-1A).

The INTEC Information Center occurrence reports were examined and compared with existing ECAs to determine whether any undocumented environmental release sites were present within the Tank Farm boundary. The comparison revealed that a 1997 occurrence report, ID-LITC-WASTEMGNT-1997-0026, provided in Appendix E, was not previously identified as an ECA. This occurrence was a NO_x fluid leak dripping on the ground next to the CPP-605 building entrance. The leak was caused by an incomplete weld on an NWCF tank discharge pipeline.

G-1.3 H. L. Lord Report

In 1992, INEEL Facility Engineer H. L. Lord generated a letter report titled "Description of Known Contamination in the ICPP High Level Waste Tank Farm" (see Appendix E). The report contains a comprehensive review of all known ECAs and suspected environmental release sites within the Tank Farm. The information provided within this report was compared with currently known Tank Farm ECA information. The report identified two potential environmental release sites not previously identified as Tank Farm ECAs.

Both potential release sites were discovered north of CPP-604 during a 1982 excavation for low-level waste storage Tanks WL-132 and -133. The first potential release site is located within the excavation area near Building CPP-604 (the exact location is unknown). Soil with contact reading less than 5 mR/hour was used to backfill the excavation. The second potential release site is located near the bottom of Valve Box A2.

The report indicated that excavation within these areas was planned under the High Level Waste Tank Farm Replacement Project. The project, commenced in 1992 and completed in 1995, consisted of upgrading existing valve boxes with new remotely reparable valves and bringing the valve box roof to the surface, replacing pressure relief piping that had failed, and bringing into compliance pipelines that were not RCRA compliant (Machovec 1999a). Detailed project records may provide further information on encountered soil contamination.

G-2. INTERVIEWS WITH TANK FARM PERSONNEL

To investigate Tank Farm occurrences before 1972 and obtain information on undocumented environmental release sites, interviews were conducted over the phone or corresponding e-mail with experienced Tank Farm personnel. Each interviewee has at least 20 years of INTEC experience and provided eyewitness accounts of past Tank Farm activities. The following subsections provide information obtained from the interviews with Tank Farm personnel.

G-2.1 F.S. Ward Interview

F. S. Ward is a facility engineer with 21 years of Tank Farm experience. Because of his expertise and eyewitness observations of Tank Farm activities, he was able to identify five undocumented potential environmental release sites within the Tank Farm. This information was compared with known ECAs. Information that did not correspond with known ECAs was signified as potential undocumented environmental release sites and is discussed below (see Appendix E).

The first undocumented potential release site identified by Ward encompasses the area between storage Tanks WM-191 and WM-106.[a] During underground storage tank construction, construction equipment such as trucks, cranes, and backhoes was taken to the area and rinsed with water, steam, and decontamination fluid. No liquid collection device was used, allowing contamination to accumulate. A portion of the area was checked by an unknown method for contamination before WM-191 construction, but no contamination was found (see Appendix E).

The second undocumented potential release site originated from a hydraulic oil spill between 1986 and 1988 from a P&H construction crane. An estimated 1 to 10 gal spilled on the gravel surface north of WM-187 and WM-189. Because the spill was considered minimal, the oil was never removed from the ground surface. However, the oil left a noticeable 5-ft-diameter dark stain on the ground. To cover the surface discoloration, a plastic sheet was placed over the area and covered with 6 in. of gravel (see Appendix E).

The third undocumented potential release site identified by Ward pertains to abovegrade hose connection leaks. Several 20-ft hose lengths, connected end to end, were used to transfer vault liquid aboveground to the PEW Evaporator before the C-series valve box installation. Reliable records of the locations of the hose lengths are not available. As the abovegrade hoses transferred vault liquid, minor hose connection leaks occurred. Vault liquid would trickle from these connections onto the ground until the leaking connection was found and repaired. Leak locations could not be determined because of random hose placement by personnel and soil dispersion from C series valve box installation excavations (see Appendix E).

The fourth and fifth undocumented potential release sites were caused by chromate solution leaks (sodium chromate and potassium chromate, 200 to 300 ppm, and pH between 7 and 8). One was from two failed buried valves located adjacent to condenser Pit CPP-387 and northwest of Building CPP-635. Both valves were eventually repaired and placed inside Valve Box C20. The other was from a failed valve located inside a direct-bottom valve box north of CPP-635. It is unknown whether the contaminated soil was removed from these locations or left in place (see Appendix E).

---

a. This area is located north of Tanks WM-182, WM-183, and WM-185.

G-2.2 Interviews with Other INEEL Personnel

In addition to the F. S. Ward interview, other interviews were conducted with INEEL employees possessing knowledge about the Tank Farm. It was determined that the information obtained was already previously documented as ECAs. The following is a list of the other interviewed INEEL employees (see Appendix E):

- D. W. Mecham, Waste Configuration Management Engineer, 40 years of experience
- D. M. Staiger, High Level Waste Program Advisory Engineer, 25 years of experience
- L. C. Mitchell, Consulting Technical Specialist, Quality Engineer, Site-wide INEEL Nonconformance Report (NCR) Coordinator, INTEC NCR Coordinator, INTEC Occurrence Report Coordinator, 24 years of INEEL experience
- D. C. Machovec, High Level Waste Program Advisory Engineer, 21 years experience (no transcripts were generated because of the simplicity and brevity of the interview).

G-2.3 Interviews with Former INEEL Personnel

During the interview process, a list of retired INEEL employees was compiled for further investigation of possible undocumented environmental release sites within the Tank Farm. Most of the retired employees could not be contacted because either their whereabouts were unknown or they had deceased. Those contacted were unable to recall any environmental releases sites not previously documented as ECAs. The following is a list of retired individuals who were contacted:

- R. Kern
- J. Cole
- G. K. Cederberg
- G. E. Lohse
- P. Richert
- D. Reed
- P. Mickelsen
- M. Young.

G-3. REFERENCES

U.S. Department of Energy Manual M 232.1-1A, "Occurrence Reporting and Processing of Operations Information," September 21, 1997.

DOE-ID, October 1999, *Final Scope of Work for the Waste Area Group 3, Operable Unit 3-14, Tank Farm Soil and Groundwater, Remedial Investigation/Feasibility Study*, DOE/ID-10653, Rev. 0, U.S. Department of Energy, Idaho Operations Office.

Machovec, D. C., June 21, 1999, Interdepartmental e-mail to P. A. Tucker, Lockheed Martin Idaho Technologies Company.

Management Control Procedure MCP-190, "Event Investigation and Occurrence Reporting," Rev. 4, Bechtel BWXT Idaho, LLC.